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Specifications for Electrical Construction

Ann Arbor
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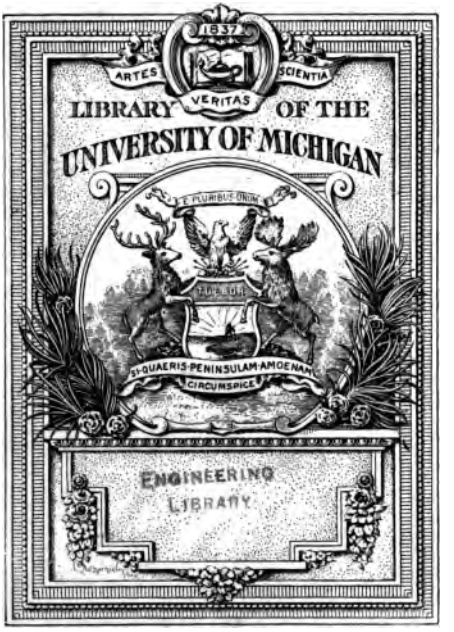

THE GIFT OF

George W Adams

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Specifications for Electrical Construction

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INTRODUCTION

There are many architects, general contractors and others who are often called upon to draw up specifications for electrical work, but who do not have the necessary information at hand. It is for the aid of such that this book is designed. It is intended to provide good modern construction for work of comparatively small extent. Equipments of larger size, and particularly those including special apparatus, should be referred to a competent Electrical Engineer.

The various sections have been numbered consecutively and a careful tabulation made of the sections to be used for various typical equipments. It is, of course, impossible to provide in this classification for every possible case, but it is thought that the divisions are such as to be of material value. It is the intention to have the typewriter copy directly from the text.

There are three important characteristics of a well written specification. It will state

plainly and completely the exact work contemplated. The violation of this principle is responsible for a goodly proportion of the misunderstandings with contractors. Again it will plainly indicate the grade of workmanship required and exactly define the duties of the contractor. Lastly, it will provide definitely for the use of good, approved materials. Having these qualities, the specification is complete no matter how brief it may be; without them it is an invitation for trouble.

A study of the Electrical Fire Loss demonstrates the need of effective provisions for good wiring. By far the major portion of the fires charged to electricity are due to defective construction or fittings, and in view of the hazard involved to property and life the neglect of proper precautions is nothing short of criminal. It is in the hope that these pages may be of assistance in promoting good construction that they are offered.

Corrections of errors or suggestions for improvement in matter or arrangement will be appreciated.

SPECIFICATIONS FOR ELECTRICAL CONSTRUCTION

DIRECTIONS FOR USE

The following paragraphs contain all necessary details for the various classes considered. Work not properly covered and involving technical details should be referred to a competent consulting engineer. The specification is divided into five parts: **General**—including terms of contract, etc.; **Description**—where is stated exactly the work proposed; **Labor**—giving the method of construction; **Material**—Where all materials are specified; and **Schedule** — in which are tabulated the conductors, lights, switches and circuits.

In general each paragraph treats of only one subject. They are numbered and in the following tables are given the numbers of the proper sections to use for various classes of work. Variations and additions in some particulars to provide for local con-

ditions or rules will, of course, be sometimes necessary. Blank pages have been provided for convenience in making such corrections, and spaces have also been left in the specifications of apparatus and material in which specific makes may be inserted if desired.

Turn in the tables to the proper set of paragraphs, determining this by (1st) the source of current, (2nd) the method of wiring, (3rd) the equipment—lighting, motors, or lighting and motors. In the paragraphs thus found, there will be some blanks to be filled to provide for the individual case. Table Five, page 21, gives a memorandum of the information necessary for these blanks. Other special points may be added when necessary.

TABLE I

CURRENT OBTAINED FROM OUTSIDE SERVICE

KNOB AND TUBE WORK.

Lighting. Sections 1 to 12, 13, 22, 23, 26, 33, 34, 36 to 39, 41, 44, 50, 53 to 56, 58 to 62, 64 to 67, 71 to 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 26, 33, 34, 36 to 39, 44, 50, 54 to 56, 58 to 62, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 26, 33, 34, 36 to 39, 41, 44, 50, 53 to 56, 58 to 62, 64 to 67, 71 to 75, 77, 79, 82 or 83, 84.

CONDUIT WORK.

Lighting. Sections 1 to 13, 22, 23, 27, 33 to 37, 43, 45, 50, 52, 53, 57 to 62, 64 to 66, 69, 71 to 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 27, 33 to 37, 43, 45, 50, 52, 57 to 62, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 27, 33 to 37, 43, 45, 50, 52, 53, 57 to 62, 64 to 66, 69, 71 to 75, 77, 79, 82 or 83, 84.

OPEN WORK.

Lighting. Sections 1 to 13, 22, 23, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 66, 68, 72, 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 28, 33, 34, 36 to 38, 40, 42, 47, 50, 51, 54, 55, 58 to 63, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 66, 68, 72 to 75, 77, 79, 82 or 83, 84.

MIXED—KNOB AND TUBE AND CONDUIT WORK.

Lighting. Sections 1 to 13, 22, 23, 29, 33 to 39, 41, 43, 44, 48, 50, 52, 53, 54, 57 to 62, 64 to 66, 69 to 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 29, 33 to 39, 43, 44, 48, 50, 52, 54, 57 to 62, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 29, 33 to 39, 41, 43, 44, 48, 50, 52 to 54, 57 to 62, 64 to 66, 69 to 75, 77, 79, 82 or 83, 84.

MIXED—KNOB AND TUBE AND OPEN WORK.

Lighting. Sections 1 to 13, 22, 23, 30, 33, 34, 36 to 42, 46, 49 to 51, 53 to 56, 58 to 66, 70 to 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 30, 33, 34, 36 to 40, 42, 46, 49 to 51, 54 to 56, 58 to 63, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 30, 33, 34, 36 to 42, 46, 49, 50, 51, 53 to 56, 58 to 66, 70 to 75, 77, 79, 82 or 83, 84.

MIXED—CONDUIT AND OPEN WORK.

Lighting. Sections 1 to 13, 22, 23, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 54, 57 to 66, 69 to 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 52, 54 57 to 63, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 31, 33 to 38, 40, 42, 43, 46 to 48, 50, 52 to 54, 57 to 66, 69 to 75, 77, 79, 82 or 83, 84.

MIXED—KNOB AND TUBE, CONDUIT AND OPEN WORK.

Lighting. Sections 1 to 13, 22, 23, 32 to 43, 46, 48 to 54, 57, 58, 69, 70 to 73, 82 or 83, 84.

Motors. Sections 1 to 12, 14, 22, 23, 32 to 40, 42, 43, 46, 48 to 52, 54, 57 to 62, 74, 75, 77, 79, 82 or 83, 84.

Lighting and Motors. Sections 1 to 12, 15, 22, 23, 32 to 43, 46, 48 to 54, 57 to 66, 69 to 75, 79, 82 or 83, 84.

TABLE II

CURRENT FROM OWN PLANT

Not Including Generators or Switchboard.

KNOB AND TUBE WORK.

Lighting. Sections 1 to 12, 16, 22, 24, 26, 33, 34, 36 to 39, 41, 44, 50, 53 to 56, 58 to 62, 64 to 67, 71 to 73.

Motors. Sections 1 to 12, 17, 22, 24, 26, 33, 34, 36 to 39, 44, 50, 54 to 56, 58 to 62, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 26, 33, 34, 36 to 39, 41, 44, 50, 53 to 56, 58 to 62, 64 to 67, 71 to 75, 77, 79.

CONDUIT WORK.

Lighting. Sections 1 to 12, 16, 22, 24, 27, 33 to 37, 43, 45, 50, 52, 53, 57 to 62, 64 to 66, 69, 71 to 73.

Motors. Sections 1 to 12, 17, 22, 24, 27, 33 to 37, 43, 45, 50, 52, 57 to 62, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 27, 33 to 37, 43, 45, 50, 52, 53, 57 to 62, 64 to 66, 69, 71 to 75, 77, 79.

Open Work.

Lighting. Sections 1 to 12, 16, 22, 24, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58, to 66, 68, 72, 73.

Motors. Sections 1 to 12, 17, 22, 24, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 62, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 66, 68, 72 to 75, 77, 79.

Mixed—Knob and Tube and Conduit Work.

Lighting. Sections 1 to 12, 16, 22, 24, 29, 33 to 39, 41, 43, 44, 48, 50, 52 to 54, 57 to 62, 64 to 66, 69 to 73.

Motors. Sections 1 to 12, 17, 22, 24, 29, 33 to 39, 43, 44, 48, 50, 52 to 54, 57 to 62, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 29, 33 to 39, 41 to 44, 48, 50, 52 to 54, 57 to 62, 64 to 66, 69 to 75, 77, 79.

Mixed—Knob and Tube and Open Work.

Lighting. Sections 1 to 12, 16, 22, 24, 30, 33, 34, 36 to 42, 46, 49 to 51, 53 to 56, 58 to 66, 70 to 73.

Motors. Sections 1 to 12, 17, 22, 24, 30, 33, 34, 36 to 40, 42, 46, 49 to 51, 54 to 56, 58 to 63, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 30, 33, 34, 36 to 42, 46, 49 to 56, 58 to 66, 70 to 75, 77, 79.

MIXED—CONDUIT AND OPEN WORK.

Lighting. Sections 1 to 12, 16, 22, 24, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 54, 57 to 66, 69, 70 to 73.

Motors. Sections 1 to 12, 17, 22, 24, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 52, 54, 57 to 63, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 54, 57 to 66, 69 to 75, 77, 79.

MIXED—KNOB AND TUBE, CONDUIT AND OPEN WORK.

Lighting. Sections 1 to 12, 16, 22, 24, 32 to 42, 46, 48 to 54, 57 to 66, 69 to 73.

Motors. Sectons 1 to 12, 17, 22, 24, 32 to 40, 42, 43, 46, 48 to 52, 54, 57 to 63, 74, 75, 77, 79.

Lighting and Motors. Sections 1 to 12, 18, 22, 24, 32 to 43, 46, 48 to 54, 57 to 66, 69 to 75, 77, 79.

TABLE III

CURRENT FROM OWN PLANT

Including Generators and Switchboard.

KNOB AND TUBE WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 26, 33, 34, 36 to 39, 41, 44, 50, 53, 54 to 56, 58 to 62, 64 to 67, 71 to 78, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 26, 33, 34, 36 to 39, 44, 50, 54 to 56, 58 to 62, 74 to 81.

Lighting and Motors. Sections 1 to 12, 21, 22, 25, 26, 33, 34, 36 to 39, 41, 44, 50, 53 to 56, 58 to 62, 64 to 67, 71 to 81.

CONDUIT WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 27, 33 to 37, 43, 45, 50, 52, 53, 57 to 62, 64 to 66, 69, 71 to 78, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 27, 33 to 37, 43, 45, 50, 52, 57 to 62, 74 to 81.

Lighting and Motors. Sections 1 to 12, 20, 22, 25, 27, 33 to 37, 43, 45, 50, 52, 53, 57 to 62, 64 to 66, 69, 71 to 81.

OPEN WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 66, 68, 72 to 78, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 28, 33, 34, 36, 37, 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 63, 74 to 81.

Lighting and Motors. Sections 1 to 12, 21, 22, 25, 28, 33, 34, 36 to 38, 40, 42, 46, 47, 50, 51, 54, 55, 58 to 66, 68, 72 to 81.

MIXED—KNOB AND TUBE AND CONDUIT WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 29, 33 to 39, 41, 43, 44, 48, 50, 52 to 54, 57 to 62, 64 to 66, 69 to 75, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 29, 33 to 39, 43, 44, 48, 50, 52, 54, 57 to 62, 74 to 81.

Lighting and Motors. Sections 1 to 12, 21, 22, 25, 29, 33 to 39, 41, 43, 44, 48, 50, 52 to 54, 57, 58 to 62, 64 to 66, 69 to 81.

MIXED—KNOB AND TUBE AND OPEN WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 30, 33, 34, 36 to 42, 46, 49 to 51, 53 to 56, 58 to 66, 70 to 78, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 30, 33, 34, 36 to 40, 42, 49 to 51, 54 to 56, 58 to 63, 74 to 81.

Lighting and Motors. Sections 1 to 12, 21, 22, 25, 30, 33, 34, 36 to 42, 46, 49 to 51, 53 to 56, 58 to 66, 70 to 81.

MIXED—CONDUIT AND OPEN WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 54, 57 to 66, 69 to 73, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 52, 54, 57 to 63, 74 to 81.

Lighting and Motors. Sections 1 to 12, 21, 22, 25, 31, 33 to 38, 40, 42, 43, 46 to 48, 50 to 54, 57 to 66, 69 to 81.

MIXED—KNOB AND TUBE, CONDUIT AND OPEN WORK.

Lighting. Sections 1 to 12, 19, 22, 25, 32 to 42, 46, 48 to 54, 57 to 66, 69 to 78, 80, 81.

Motors. Sections 1 to 12, 20, 22, 25, 32 to 40, 42, 43, 46, 48 to 52, 54, 57 to 63, 74 to 81.

Lighting and Motors. Sections 1 to 12, 21, 22, 25, 32 to 43, 46, 48 to 54, 57 to 66, 69 to 81.

TABLE IV

SPECIFICATIONS FOR SPECIAL WORK

When the special work is to be provided for in the general wiring specification the sections indicated below may be added to those selected from Tables I, II or III.

Fixtures. Section 86.

Wiring Exposed to Moisture. Section 87.

Wiring in Show Windows. Section 89.

Motors on Grounded Trolley Service. Sections 91, 92.

Moving Picture Machine Equipments. Sections 94 to 99.

Electric Bells. Section 100.

When separate specifications are desired for any of these use the sections indicated below.

Fixtures. Sections 1 to 12, 85, 86.

Wiring in Show Windows. Sections 1 to 12, 88, 89, 33 to 35, 37, 43, 45, 50, 52.

Motors on Grounded Trolley Service. Sections 1 to 12, 90 to 92, 33 to 38, 40, 43, 44, 48, 50, 52, 54, 59, 62, 75, 77, 79.

Moving Picture Machine Equipment. Sections 1 to 12, 93 to 99, 28, 33, 34, 36 to 38, 40, 51, 54, 59, 60, 62.

Electric Bells. Sections 1 to to 12, 100.

TABLE V

DATA TO FILL BLANKS IN SPECIFICATIONS

The numbers correspond to those found in the blanks.

1. Name of purchaser.
2. Name of engineer.
3. Date up to which proposals will be received.
4. Amount of certified check.
5. Number of days within which contract must be entered into after proposal is accepted.
6. Amount of Surety Bond.
7. Name or number of buildings to be wired.
8. Nature of construction of buildings—brick, frame, etc.
9. Material of walls.
10. Material of partitions.
11. Material of floors.
12. Height of basement floor.
13. Height of 1st, 2nd floors, etc.

14. Special directions for run of mains from meter location.
15. Special directions for run of mains from switchboard.
16. Special directions for run of mains from generator to switchboard.
17. Location of knob and tube work.
18. Location of conduit work.
19. Location of open work.
20. Number of extension cords to be provided.
21. Number of incandescent lamps to be provided.
22. Voltage of incandescent lamps.
23. Number of arc lamps to be provided.
24. Voltage of arc lamps.
25. Number of generators to be provided.
26. Voltage of generators.
27. Capacity of generators in kilowatts.
28. Speed of generators in R. P. M.
29. Type of generators—Belted, direct connected, etc.
30. Number of motors to be provided.
31. Voltage at which motors are to operate.
32. Capacity of motors in horse power.
33. Speed of motors in R. P. M.
34. Type of motors—enclosed, semi-enclosed, open, geared, etc.
35. Upper reading of volt-meter.

36. Upper reading of ammeter.
37. Voltage at which switches on switchboard are to be used.
38. Type of main switch,—double or triple pole.
39. Capacity of main switch on switchboard in amperes.
40. Capacity of circuit-breaker in amperes.
41. Capacity of circuit switches in amperes.
42. Designation of branch circuits.
43. Capacity of main switch and cutout at service entrance.
44. Voltage of system.
45. Rooms or building for which fixtures are to be furnished.
46. Finish of fixtures.
47. Buildings or rooms where moisture proof construction is to be used.
48. Location of show windows to be wired.
49. Location of motor on trolley service.
50. Capacity in horse powers of motor on trolley service.
51. Location of moving picture machine.
52. Location of electric bell.
53. Location of push-button.
54. Size of annunciator.

NOTES

GENERAL CONDITIONS

Under this head are included all the provisions which may be common to every contract. The practice of different engineers and architects varies widely, some including only a few important items while others go into very minute detail. In many offices this portion of the specification is a printed form with a few blanks to be filled out for the particular case in hand.

(1)

Intent—These specifications with their accompanying drawing contemplate a complete and finished piece of work. They are intended to be co-operative and details called for by either are to be provided as though called for by both. Any points not clearly understood shall be referred to the engineer before proceeding with the work. Dimensions on drawings shall be followed rather than scale measurements.

(2)

Terms—Where the terms "purchaser" and "Engineer" are used, they refer respectively to ——(1)—— and ——(2)——.

NOTES

(3)

Proposals—Sealed proposals on the work contemplated by these specifications will be received at the office of ——(2)— up to ——(3)——.

(4)

The right is reserved to reject any or all bids.

(5)

Additions and Alterations—The Engineer shall have full power to make any alterations or additions during the progress of the work that may be deemed necessary. Such work shall be done without undue delay and only on written order of the engineer, and shall not affect nor make void the original contract. Where alterations do not involve additional cost, no charge shall be made for the same. Where additional cost is involved, the extra charge shall be on the basis of going prices for material and labor and a fair profit, and if possible, shall be agreed upon in advance. In case of disagreement on this valuation, the matter shall be referred to a competent and disinterested board of arbitration consisting of three members, one chosen by the owner, one chosen by the contractor and the

NOTES

third chosen by the other two members, whose decision shall be final and binding, and whose expenses shall be borne equally by the purchaser and contractor.

(6)

Forfeiture of Contract—If at any time the contractor should fail in the proper performance of this contract, either through the lack of properly skillful workmen or of a sufficiency of material of the required quality, or because of any other neglect or failure, the purchaser shall be at liberty to terminate this contract and make other arrangements for its completion. Any expense thus incurred by the purchaser shall be paid by this contractor.

(7)

Duties of Contractors—Neither the whole nor any part of the work under this contract is to be sub-let without the written consent of the purchaser.

The work must be delivered free from all mechanic's liens or other claims chargeable to the contractor.

This contractor is to provide all blocking, scaffolding and supports and shall remove all refuse, materials and rubbish and deliver the work in perfect condition. All

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necessary cutting or repairing of walls, etc., is to be done by the contractor or at his expense.

The contractor shall obtain all necessary permits and arrange for inspection by the department having jurisdiction and pay the fees for the same, and be responsible for any violations of public Rules or Ordinances pertaining to this work.

(8)

Material and Workmanship—All material and workmanship is to be first-class and subject to the approval or rejection of the engineer. Materials not conforming to these specifications and defective work which is so rejected must be replaced by this contractor at his own expense. All material subject to approval of the Underwriters' Laboratories must be of makes passed and listed in the "List of Approved Materials."

(9)

Certified Check—A certified check to the amount of ——(4)—— must accompany each bid. If the bidder is notified of the acceptance of his proposal, he must agree that within ——(5)—— days he will enter into contract to complete the work according to the plans and specifications or forfeit said check to the purchaser.

NOTES

(10)

Bond—The contractor will be required to furnish a Guarantee or Surety Bond in the sum of ——(6)—— for the full and proper completion of his contract.

(11)

Payments—Payments will be made only on the order of the Engineer.

(12)

Plans and Specifications—These plans and specifications are the property of ——(2)—— and are to be returned to him with proposal.

NOTES

DESCRIPTION

From the nature of the case, the "Description" cannot be very completely given in an outline specification. It should state the particular requirements of the work proposed so exactly as to leave no possible doubt in the mind of the contractor as to just what his contract includes.

From it he should learn whether the wiring is for lighting or power, whether lamps, motors, generators, switchboards, etc. are included or not, just what buildings or portions of buildings are included, the run of mains if a particular location is desired, and other similar points. The description cannot be too accurate.

(13)

Description—These specifications are intended to provide for a complete wiring equipment for electric lights from the point of entrance of the mains to the various centers, switches and outlets all as hereafter specified.

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(14)

Description—These specifications are intended to provide for a complete wiring equipment for motors from the point of entrance of the mains to the various motors, including the proper connections of switches, motors, fuses and starting-boxes, all as hereafter specified.

(15)

Description—These specifications are intended to provide for a complete wiring equipment for electric lights and motors from the point of entrance of the mains to the various centers, switches, outlets and motors and including the proper connections of switches, motors, fuses and starting-boxes, all as hereafter specified.

(16)

Description—These specifications are intended to provide for a complete wiring equipment for electric lights from the switchboard to the various centers, switches and outlets, all as hereafter specified.

(17)

Description—These specifications are intended to provide for a complete wiring equipment for motors from the switchboard

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to the various motors, including the proper connection of switches, motors, fuses and starting-boxes, all as hereafter specified.

(18)

Description—These specifications are intended to provide for a complete wiring equipment for electric lights and motors from the switchboard to the various centers, switches, outlets and motors, and including the proper connections of switches, motors, fuses and starting-boxes, all as hereafter specified.

(19)

Description—These specifications are intended to provide for a complete wiring equipment for electric lights from the generator to the various centers, switches and outlets and including the connections to generators and switchboard, all as hereafter specified.

(20)

Description—These specifications are intended to provide for a complete wiring equipment for motors from the generators to the various motors, including the proper connection of switches, motors, fuses and starting-boxes and the connections to generator and switchboard, all as hereafter specified.

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(21)

Description—These specifications are intended to provide for a complete wiring equipment for electric lights and motors from the generator to the various centers, switches, outlets and motors, and including the proper connection of switches, motors, fuses and starting-boxes, and the connections to generator and switchboard all as hereafter specified.

(22)

The buildings to be wired are ——(7)——, of ——(8)—— construction. The outer walls are ——(9)——, partitions ——(10)——, floors ——(11)——. The ceiling heights are as follows: Basement ——(12)—— ft.,.... inches; 1st floor ——(13)—— ft.,.....inches, etc.

NOTE:—*Repeat above form for each building unless they are identical in construction. Add to this paragraph such other details as may be necessary for a proper description of the buildings.*

(23)

The mains are to run from the point of entrance to main fuse and switch, thence to the meter and thence ——(14)—— to the various centers of distribution. Branch mains and circuits to be run from the centers of distribution as needed.

NOTES

(24)

Mains are to be run from the switchboard ——(15)—— to the various centers of distribution. Branch mains and circuits to be run from the centers of distribution as needed.

(25)

Generator leads are to be run from generator to the switchboard ——(16)——. Mains are to run from the switchboard ——(15)—— to the various centers of distribution. Branch mains and circuits to be run from the centers of distribution as needed.

(26)

All wiring is to be run concealed as knob and tube work.

(27)

All wiring is to be run in conduit.

(28)

All wiring is to be run open.

(29)

Wiring in ——(17)—— is to be run concealed as knob and tube work and in ——(18)—— is to be run in conduit.

NOTES

(30)

Wiring in ——(17)—— is to be run concealed as knob and tube work and in ——(19)—— is to be run open.

(31)

Wiring in ——(18)—— is to be run in conduit and in ——(19)—— is to be run open.

(32)

Wiring in ——(17)—— is to be run concealed as knob and tube work, in ——(18)—— is to be run in conduit, and in ——(19)—— is to be run open.

NOTES

LABOR

(33)

Workmanship—All work is to be done in a first-class workmanlike way. Care is to be taken that wire and other material is not injured in handling.

(34)

Splices are to be avoided as much as possible. When needed they are to be carefully made and well soldered. A layer of good rubber tape is to be put on while the joint is hot, this is to be covered with a layer of friction tape, the whole to be well painted with P. & B. or other satisfactory compound.

(35)

No splices will be permitted in conduit except in junction boxes or outlet boxes. At outlets wires must be properly connected, soldered and taped, so that the only bare ends left are those necessary for connection to switch or fixture.

NOTES

(36)

Wires larger than No. 10 B. & S. must be soldered into lugs for making connection to switches and other apparatus. Care must be taken that the soldering is thoroughly done, especially in the case of stranded conductors.

(37)

All switches, receptacles and other apparatus are to be securely fastened in place and wires are to be properly connected.

(38)

Wires are to be drawn taut and kept free from kinks. Where they pass through walls, floor timbers, partitions, etc., the wires must be protected by porcelain insulating tubes. Supports must be provided at the end of runs, adjacent to splices and so placed as to relieve splices of strain, and at least every four and a half feet on straight runs.

Holes through floor joists for insulators are to be kept in line and bored parallel to the bottom of the joists.

(39)

Wires run concealed must be separated at least one inch from the surface wired over and five inches apart. Where such

NOTES

separation cannot be maintained both wires must be enclosed in flexible tubing.

(40)

In open work, wires are to be separated at least ½ inch from the surface wired over, and 2½ inches from each other.

(41)

At outlets in concealed work for lights and for surface snap switches, each wire must be enclosed in flexible tubing extending from the first porcelain support to at least one inch beyond the outlet. Flush type switches must be installed in approved iron boxes and the flexible tubing must extend into the box.

(42)

Where moulding is used, it is to be neatly fitted and securely fastened in place, corners to be mitered.

(43)

In fitting conduit, care must be taken that the ends of the tubes are well reamed out, removing all burrs, fins, etc. Check nuts must be firmly set up. Bushings must be used to protect all ends of conduit.

Bends and elbows must be of at least 3½ inches radius, and no run shall be made

NOTES

with more than four right angle turns between junction boxes or outlets. Pull boxes shall also be placed so as to divide all long runs.

No wires are to be pulled in until all work is complete on the conduit systems. In pulling in, plenty of soap-stone shall be used to prevent any possibility of injury to the conductors.

Junction boxes and pull boxes are to be so installed as to be readily accessible after building is complete.

Conduit shall be of such size as to properly contain the required conductors and in no case to be less than ⅝ inch inside diameter.

The whole conduit system must be effectively grounded to structural iron work, water-pipes or other permanent ground. Where a thoroughly good connection is not obtained through junction boxes and distributing cabinets, the conduits must be joined around them by a suitable bond wire. When ground connections are complete, there must be a thorough connection between all parts of the conduit systems and the ground.

NOTES

MATERIAL

In these specifications of materials blanks have been left which may be filled in with name of maker or goods if desired. If this is not used omit blank in copying.

(44)

Wire—All wire is to be ———————— 98% copper with high-grade rubber insulation, full B. & S. gauge, of sizes shown in schedule.

(45)

Wire—All wire is to be ———————— 98% copper with high-grade rubber insulation and extra outer braid as required for unlined conduit full B. & S. gauge, of sizes shown in schedule.

(46)

Wire—All wire is to be ———————— 98% copper with high-grade rubber or slow-burning weather-proof insulation full B. & S. gauge of sizes shown in schedule.

NOTES

(47)

Rubber covered wire is to be used in moulding and for open work in basements, under roofs, and in other places exposed to moisture. Slow-burning weatherproof may be used for open work in other locations.

(48)

Wire run in conduit is to be rubber covered and must have an extra outer braid as required for unlined conduit.

(49)

Rubber covered wire is to be used for concealed work, in moulding, and for open work in basements, under roofs, and in other places exposed to moisture. Slow-burning weatherproof may be used for open work in other locations.

(50)

Rubber covered wire is to be well tinned and accurately centered in the insulation which must adhere closely to the wire. Outer braid is to be substantial and close-fitting and well filled with preservative compound. All requirements of the National Electrical Code for diameter of wire, thickness of insulation and tests must be fully complied with.

NOTES

(51)

Slow burning weatherproof wire is to be triple braid, and comply fully with all requirements of the National Electrical Code as to diameter of wire, insulation and tests.

(52)

Conduit—All conduit is to be unlined, ———————— and each length is to bear the stamp of the Underwriters' Laboratories. No conduit is to be less than ⅝ inch internal diameter.

(53)

Outlet Boxes—All outlet boxes are to ———————— of proper type for the use intended. They are to be secured in place with screws through the back into a piece of wood fastened between the joists and so located that the face of the box will be ⅛ inch below the finished plaster line. On conduit run open and at outlets where boxes are not plastered in use condulets of proper type.

(54)

Porcelain—Knobs, tubes and cleats are to be ———————— best porcelain, free from cracks or sharp edges which would

NOTES

injure the covering of the wire. Knobs are to be two-piece, self-confining.

(55)

Cutout Cabinets—Are to be of 1 inch clear pine of sufficient size to contain the number of cutouts required. They are to be lined throughout with ⅛ inch asbestos board which is to be neatly fitted and secured in place by glue and tacks. Where the wires enter the box they are to be protected with porcelain bushings.

(56)

When circuit wires are encased in flexible tubing where the five inch separation cannot be maintained in running to cabinet these bushings shall be omitted and the tubing run clear to the cutout base.

(57)

Cutout Cabinets—Are to be of steel of sufficient size to accommodate the designed number of circuits. Fuses are to be mounted on slate panel board. Conduits are to enter wiring channel and be secured in place with lock nuts and bushings.

(58)

The frame and door are to match the adjacent woodwork in style and finish. The

NOTES

door is to be tight fitting against a jamb or rabbit, lined with 1/8 inch asbestos and provided with stout hinges and a good flat key lock. Two extra keys to be furnished.

(59)

Fuses—All fuses for over 30 amperes capacity are to be _____ enclosed cartridge type.

(60)

Circuit fuses and others under 30 amperes capacity are to be plug type of approved make. A complete extra set of fuses is to be provided.

(61)

Circuit fuses mounted on panel boards are to be link type with copper terminals. A complete extra set of fuses is to be provided.

(62)

Switches—Knife Switches are to be _____ slate or porcelain base with spacings, dimensions of metal parts, arrangements of terminals, etc., all as required in Rule 51 of the National Electrical Code, and are to be of approved make. Each switch must be stamped on the blade or handle with the maker's name, and the voltage, and current for which it is designed.

NOTES

Snap Switches will be ———————— surface snap, flush snap or push-button type as indicated in schedule. Surface snap switches used in open or moulding work are to be furnished with proper sub-base. Flush snap and push-button type are to be enclosed in iron outlet boxes as elsewhere specified.

(63)

Moulding is to be made of good clear stock free from splits or breaks and painted two coats inside and out of good oil paint. Dimensions must be as required in the National Electrical Code.

(64)

Flexible Cord used for pendants not subject to hard usage is to be ———————— No. 18 "new code" cord with close woven cotton covering. All portable cords and long drop cords liable to be carried about and all pendants marked "re-enforced" in schedule are to be of approved re-enforced cord.

Portable Cords for attachment of irons and other heating devices are to be ———— ———————— asbestos covered. All cord to be of approved make "new code" standard.

NOTES

(65)

Sockets are to be ———————— Edison base, full lined, key unless marked otherwise in schedule. Where sockets are used on drop cords, they must be provided with bushings.

(66)

Receptacles are to be ———————— Edison base, porcelain, keyless, without shade holders, and fuseless.

(67)

Rosettes are to be ———————— two piece, adapted for back connection to concealed work.

(68)

Rosettes are to be ———————— two piece moulding type, or one piece cleat type.

(69)

Drop Cords on conduit work are to be suspended from rosettes or condulets.

(70)

Rosettes are to be ———————— of type adapted for wiring to which they are connected.

NOTES

(71)

Baseboard Plugs are to be installed where shown on plans and are to consist of ———————— 10 ampere flush receptacle and plug.

(72)

Extension Cords—Provide ——(20)—— extension cord consisting of Edison base key socket with a stout wire guard, Edison base attachment plug and ten feet of re-enforced cord. Cord is to be secured into both socket and plug with an approved cord grip.

(73)

Lamps—Provide ——(21)—— Edison base, ——(22)—— volt, 3½ watt, 16 candle power incandescent lamps. Make to be supplied must be stated in bid. Lamps to be guaranteed to average 600 hours life.

(74)

Electric Machinery—This contractor is to provide and erect the following machines on the foundations furnished by the purchaser.

GENERATORS.

No.	Voltage	K. W.	Speed	Type
-(25)—	—(26)—	—(27)—	—(28)—	—(29)-

NOTES

MOTORS.

No. Voltage H. P. Speed Type
-(30)— —(31)— —(32)— —(33)— —(34)-
(Repeat for different sized machines.)

Templet—Contractor is to furnish templet or foundation bolt layout as required.

(75)

Guarantee—The machine(s) shall be guaranteed to operate at rated voltage and full rated load in amperes continuously or at rated voltage and 25% overload in amperes for one hour followed by a continuous three hour run at full load. Under neither of these tests shall any part of the machine except the commutator heat more than fifty degrees Fahrenheit above the temperature of the surrounding air, and the commutator shall not heat over sixty degrees Fahrenheit above the surrounding air.

Bidder is to state efficiency at ¼, ½, ¾, full load and 25% overload.

(76)

The generator compounding is to be so proportioned that at the same speed the voltage at full load shall be five per cent. higher than at no load. Between no load and full load the voltage is to increase in

NOTES

proportion to the load without moving rheostat or shifting brushes. From no load to full load the speed shall not vary more than 2%.

(77)

Mechanical Construction—The frame, bearings and other parts shall be properly proportioned to the strains placed upon them. The bearings must not heat and are to be provided with oil rings or equivalent device. The armature is to be perfectly balanced and the machine must run without jar or vibration. There must be no excessive or injurious sparking at the brushes under any load conditions specified, or at change from full load to no load. Brush holder is to have proper adjustments for tension on brushes and for position and is to be so arranged that brushes may be raised individually.

Sub-base or slide rails with adjustment for tightening belt are to be provided.

One extra set of brushes is to be provided.

(78)

Rheostat—This contractor is to furnish and erect an enamel type field rheostat for each generator. Rheostat is to be arranged for back connection on switchboard and is

NOTES

to be of proper resistance to reduce voltage to at least 50% of the rated voltage of the machine and is to control the voltage by divisions of at most one volt for twenty volts above and below the rated voltage.

(79)

Starting Rheostat—This contractor is to furnish and erect an approved type starting rheostat for each motor. Rheostats are to be of proper size and resistance for the required voltage and horse power, are to be provided with automatic no-voltage release and mounted on slate panel.

(80 a) (Wooden Floors)

Connection of Generators—Conductors from generator to switchboard are to be rubber covered cables. They are to be run in conduit and the conduit is to be brought six inches above the floor level and installed in accordance with the rules for conduit work. Ends of conduit to be provided with condulets or with bushings and sealed. Conductors are to be well sweated into lugs.

(80 b) (Concrete Floors)

Conductors from generator to switchboard are to be lead covered, paper insulated cables installed in crocks laid in floor.

NOTES

Crocks are to extend at least six inches above floor level and ends are to be well sealed around cables. Conductors to be well sweated into lugs.

(81)

Switchboard is to be of 1½ inch Blue Vermont Marble free from metallic veins. Face of board is to be polished and back to be given two coats of shellac. The following instruments are to be provided:

Voltmeter, reading ——(35)——.

Ammeter, reading ——(36)——.

Two lamp ground detector.

Rheostat, as specified above.

Main switch, —(37)— volt, —-(38)— pole, ——(39)—— ampere.

Circuit breaker, ——(40)—— ampere.

Fused Circuit Switches as follows:

——(37)—— volt, ——(41)—— ampere to control line to ——(42)——.

(Repeat for each switch.)

All instruments and switches are to be mounted on the face of the board and connected to provide for the proper operation of the plant. Fuses and bus-bars are to be on the back of the board. Bus-bars are to be proportioned so that there shall not be carried to exceed 1,000 amperes per square inch of cross section of the copper.

NOTES

Supporting frame is to be of 1¼ x 1¼ inch angle iron properly bolted together and braced to wall.

Cross piece 2x4 inches is to be secured about 6 feet 6 inches from floor and circuit wires fastened thereon before leading to board.

Instruments are to be so mounted and board so designed that center of instruments comes about 6 feet 6 inches from floor.

(82)

Service Entrance—Mains are to enter the building at point marked and run to service cabinet in conduit. Outer end of conduit is to be carried to a point at least fifteen feet above grade, and is to be provided with ———————— service cap. Inner end of conduit is to enter service cabinet which is to be of iron and located as shown.

NOTE:—*When entrance is to be made above second floor and service pipe is not desired use No. 83 in place of No. 82.*

(83)

Service Entrance—Mains are to enter the building at point marked and run to service cabinet as concealed knob and tube work. Service cabinet is to be of wood

NOTES

lined with 1/8 inch asbestos board and shall be located as close as possible to the point of entrance.

(84)

Service cabinet is to contain ——(43)—— ampere, main switch and fuse block, both for ——(44)—— volts. Meter loops are to be provided.

(85)

This specification is intended to provide for the furnishing and erection of fixtures in ——(45)——. This contractor is to hang fixtures and connect same to present wiring. Joints in gas pipes to be made tight with lead. Splices in wires are to be carefully made, well soldered and covered with rubber and adhesive tape and then compounded.

(86)

Fixtures—The number of combination and straight electric fixtures, number of lights each and whether for ceiling or bracket outlets is indicated in the schedule. Finish is to be ——(46)——. Sample fixture is to be submitted with bid. Fixtures are to be provided with key sockets and insulating joints and wired with approved rubber covered fixture wire.

NOTES

(87)

Wiring Exposed to Moisture — In ——(47)—— moisture-proof construction is to be used. All wires are to be rubber covered, run open and supported on knobs as required in rule 24j of the National Code. Waterproof sockets are to be used and are to be hung on two No. 14 stranded rubber-covered wires. Cord of any kind will not be permitted. These wires are to be soldered direct to the circuit wires but are to be supported with knobs so that no strain is thrown on the joints.

Particular care must be taken not to injure the covering of wires and to properly insulate the joints with tape and compound.

Switches must be located so as not to be exposed to moisture if possible. If this cannot be avoided, they must be enclosed in marine type, water-tight iron cases with tight door and stuffing boxes about wires.

(88)

This specification is intended to provide for wiring in the show windows in ——(48)——. The circuits are to be controlled by switches located as directed.

NOTES

(89)

Show Windows—All wiring in show windows is to be in conduit. Locate lights and provide shades or reflectors as directed. Sockets are to be keyless and mounted on type "C" condulets.

Time Switch is to be provided for cutting out all lights. This switch is to be of approved make and is to be installed in an iron box.

(90)

This specification is intended to provide for the furnishing and installing of a 500 volt motor in ——(49)——, to be connected with the grounded trolley service. All this wiring to be run in conduit or as open work. Ends of conduit to be provided with condulets of proper type for the location in which they are used.

(91)

Motors on Grounded Trolley Service—Motors, starting box, switch and cutout are all to be placed in a fire-proof room located as shown.

This contractor is to furnish and erect all necessary electrical apparatus and material as follows:

NOTES

500 volt, ——(50)—— H.P. Motor, complete with starting box.

500 volt, single pole knife switch.

500 volt, single pole enclosed fuse block and fuse.

Necessary wire and supports.

The switch and fuse block are to be connected between the non-grounded side of the service and the motor. Ground connection must be made in an effective manner **outside of the building,** and, if possible, by connection to the rail or return circuit.

(92)

The fire-proof motor room is to be located as shown and built entirely of non-combustible material. The walls are to be at least 8 inches thick of brick or hollow tile. The ceiling is to be brick arch, hollow tile or suspended concrete. The floor to be concrete or brick.

All openings are to be protected with iron-clad shutters or wire-glass in strict accordance with the requirements of the National Board of Fire Underwriters.

(93)

This specification is intended to provide for the furnishing and installation of a booth and equipment for a moving picture machine in ——(51)——.

NOTES

(94)

Moving Picture Machine Enclosure—The entire equipment, electrical devices, rheostat and picture machine, and operator shall be enclosed in a room or booth substantially constructed of wood and lined throughout (walls, ceiling and floor) with a layer of asbestos board at least 1-16 inch in thickness and then with heavy tin or galvanized iron, securely fastened in place.

(95)

A wooden shelf is to be provided and covered with a sheet of asbestos at least ⅛ inch in thickness well secured in place. A rubber mat should be provided to cover metal floor.

(96)

The door is to be of the same construction as the booth and arranged to close automatically by means of a spring placed on the outside. Openings for operators' view and projection of picture are not to be larger than 12 inches by 12 inches, and are to be provided with gravity doors. These doors are to be of same construction as the room or heavy sheet iron and are to be held in place by a fusible link in series with a fine

NOTES

cord. The link must be suspended directly over the film and so arranged that its operation will drop both shutters.

(97)

Booth to have an opening for ventilation over machine, with a pipe leading to the outer air. This pipe to be at least six inches in diameter and connected to a chimney or provided with an exhaust fan.

(98)

Machine—The machine must be of standard construction as required by the National Electrical Code.

(99)

Electrical Eqiupment—Only slow burning, weatherproof wire to be used inside booth.

Portable cord must not be used except for direct connection to the lantern and this must be kept as short as possible. Only makes approved for use for Electric Heaters to be used.

(100)

Bells—Provide the following bells with necessary wire, batteries, push buttons, annunciators, etc.

NOTES

Bell in ——(52)—— controlled by push in ——(53)——.

Repeat for each bell or buzzer desired, and indicate annunciator connection where necessary.

Bells are to be ———————— vibrating 3-inch gong, iron box.

Push buttons are to be ———————— metal of design approved by the purchaser.

Wire is to be No. 18 slow-burning weatherproof and is to be secured in place with insulating staples.

Annunciator is to be ——(54)—— point and guaranteed for one year.

Provide and install enough cells of good wet battery, properly charged, to operate the system in an entirely satisfactory way.

IT is of prime importance that all materials used and specified be of makes approved by the Underwriters Laboratories. Consult

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